PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H01L 33/00	A1	(11) International Publication Number: WO 99/03158 (43) International Publication Date: 21 January 1999 (21.01.99)

(21) International Application Number: PCT/US98/13936

(22) International Filing Date: 6 July 1998 (06.07.98)

(30) Priority Data:
60/049,070 11 July 1997 (11.07.97) US
09/074,423 8 May 1998 (08.05.98) US

(71) Applicant: FED CORPORATION [US/US]; Hudson Valley Research Park, 1580 Route 52, Hopewell Junction, NJ 12533 (US).

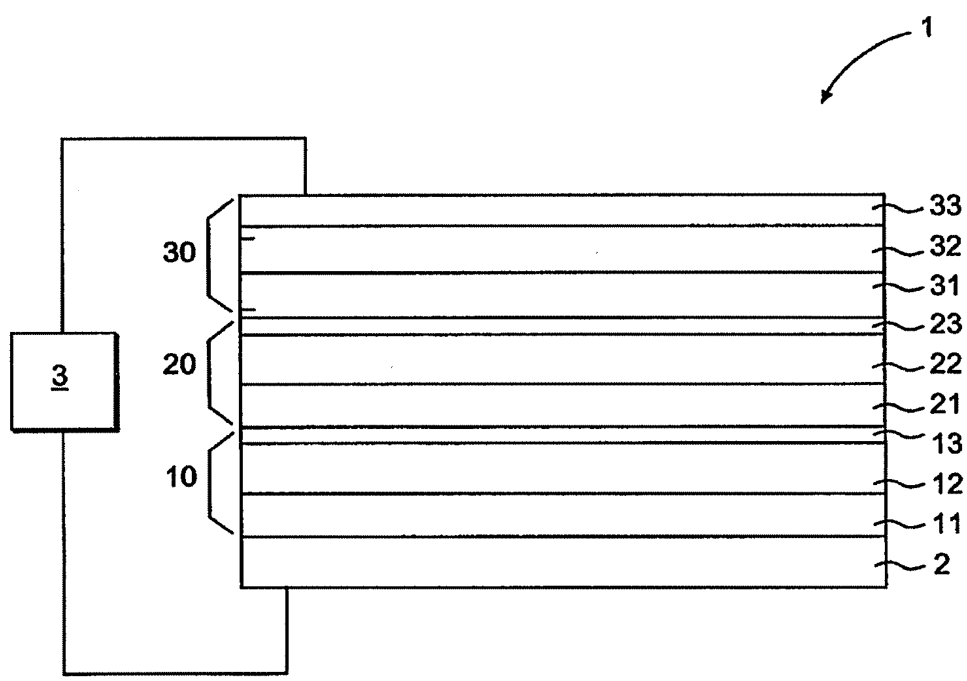
(72) Inventors: JONES, Gary, W.; 8 Taconic View Court, Langrangeville, NY 12540 (US). HOWARD, Webster, E.; 4 Lee Lane, Lagrangeville, NY 12540 (US).

(74) Agent: COYNE, Patrick, J.; Collier, Shannon, Rill & Scott, PLLC, Suite 400, 3050 K Street, N.W., Washington, DC 20007 (US).

(81) Designated States: CA, CN, IL, JP, KR, RU, SG, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: HIGH BRIGHTNESS, HIGH EFFICIENCY ORGANIC LIGHT EMITTING DEVICE



(57) Abstract

A light emitting device (1) comprises a plurality of stacked organic light emitting devices (10, 20, 30) which are arranged in a stack. The light emitting device (1) further includes a controller (3) for controlling the operation of each of the plurality of organic light emitting devices (10, 20, 30) in the stack. The controller (3) simultaneously supplies the same current to each of the organic light emitting devices (10, 20, 30) in the stack as well as to each of the plurality of organic light emitting devices (1).

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

HIGH BRIGHTNESS, HIGH EFFICIENCY ORGANIC LIGHT EMITTING DEVICE

Cross Reference To Related Patent Application

This application relates to and claims priority on Application Serial Nos. 60/049,070 filed on July 11, 1997, and 09/074,423 filed on May 8, 1998.

Field of the Invention

The present invention relates to organic light emitting devices. In particular, the present invention relates to a stacked organic light emitting device having high brightness and high efficiency.

Background of the Invention

Organic light emitting devices ("OLEDs") have been known for approximately two decades. All OLEDs work on the same general principles. One or more layers of semiconducting organic material is sandwiched between two electrodes. An electric current is applied to the device, causing negatively charged electrons to move into the organic material(s) from the cathode. Positive charges, typically referred to as holes, move in from the anode. The positive and negative charges meet in the center layers (i.e., the semiconducting organic material), combine, and produce photons. The wave-length -- and consequently the color -- of the photons depends on the electronic properties of the organic material in which the photons are generated.

The color of light emitted from the organic light emitting device can be controlled by the selection of the organic material. White light is produced by generating blue, red and green lights simultaneously. Specifically, the precisely color of light emitted by a particular structure can be controlled both by selection of the organic material, as well as by selection of dopants.

Organic light emitting devices have been shown to be capable of emitting with very high brightnesses ($>10^5$ cd/m2) and with high quantum efficiencies (2-3%).

Unfortunately, the highest brightnesses are achieved with a proportionate reciprocal decrease in lifetime of the device. Also, when power efficiency is considered, operating an OLED at high brightness (and therefore high current) leads to a reduction of power efficiency, as the devices have a significant series resistance, so that the power efficiency drops with increasing current density.

Although substantial progress has been made in the development of OLEDs to date, substantial additional challenges remain. For example, the class of devices continues to face a general series of problems associated with their long-term stability. In particular, the sublimed organic film may undergo recrystallization or other structural changes that adversely effect the emissive properties of the device.

Objects of the Invention

It is therefore an object of the present invention to provide an OLED possessing higher brightness.

Another object of the present invention is to provide an OLED with higher power efficiency.

A further object of the present invention is to provide an OLED with an increased lifetime.

Yet another object of the present invention is to provide an OLED with a low heat output. A further object of the present invention is to provide an OLED with increased light output utilizing approximately the same power as a single conventional light emitting device.

Yet another object of the present invention is to provide a transparent stackable OLED structure without requiring independent control of each of the stacked individual OLEDs.

An additional object of the present invention is to provide a transparent stacked OLED structure which draws no more current than a single OLED, but results in an increased brightness.

Yet a further object of the present invention is to provide a device with increased brightness over that of a single OLED, without loss of efficiency or loss of lifetime.

An additional object of the present invention is to provide the same brightness as a single OLED, but with increased efficiency and increased lifetime.

Additional benefits and advantages of the present invention will be apparent to those of ordinary skill in the art.

Summary of the Invention

The present invention is directed to a light emitting device comprising a plurality of organic light emitting devices. The plurality of organic light emitting devices are arranged in a stack. The light emitting device further includes control means for controlling operation of each of the plurality of organic light emitting devices in the stack. The control means supplies the same current to each of the organic light emitting devices in the stack. The control means simultaneously supplies the same current to each of the plurality of the organic light emitting devices.

The plurality of organic light emitting devices includes at least two stacked organic light emitting devices. The stack of organic light emitting devices is formed on the substrate. The first organic light emitting device of the plurality of organic light emitting devices is located on the substrate. A second organic light emitting device of the plurality of organic light emitting devices is located on the first organic light emitting device.

The light emitting device may further include an insulator layer positioned between each of the organic light emitting devices.

Each of the organic light emitting devices includes a first conductor layer, an OLED layer, and a second conductor layer. The OLED layer is sandwiched between the first and second conductor layers. The thickness of the second conductor layer of the third organic light emitting device is greater than the thickness of the second conductor layers of the first and second organic light emitting devices.

The light emitting device according to the present invention has increased brightness capability. The light emitting device according to the present invention also has increased efficiency and lifetime.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only. The description is not considered to be restrictive of the invention as claimed.

Brief Description of the Drawings

The present invention will now be described in connection with the following figures in which like reference numbers refer to like elements and wherein:

Fig. 1 is a side view of a stacked organic light emitting device according to an embodiment of the present invention;

Fig. 2 is a side view of a stacked organic light emitting device according to another embodiment of the present invention; and

Fig. 3 is a side view of a stacked organic light emitting device according to another embodiment of the present invention.

Detailed Description of the Preferred Embodiments

The present invention is directed to an improved light emitting device **1** that includes stacked organic light emitting devices. The device **1** includes a substrate **2**. The substrate **2** may be formed from glass (e.g., borosilicate glass), silicon on quartz, plastic or other suitable substrate material.

A plurality of individual organic light emitting devices **10**, **20**, and **30** are formed on the substrate **2**. A current source **3** supplies current to the plurality of individual organic light emitting devices **10**, **20**, and **30**. The present invention is described, for purpose of example, as containing three stacked individual organic light emitting devices. It, however, is contemplated by the present inventors that the present invention is not limited to three stacked organic light emitting devices. Rather, two stacked light emitting devices and more than three stacked emitting devices are all considered to be within the scope of the present invention.

As shown in Fig. 1, a first organic light emitting device **10** is formed on the substrate **2**. The first organic light emitting device **10** includes a first conductor layer **11**. The first conductor layer **11** is preferably formed as lines or, in the case of an active

matrix substrate, electrode pads, directly on the substrate **2** using conventional techniques (e.g., screen coated or lithographically patterned using conventional photoresist and etching techniques). The conductor layer **11** is preferably transparent and formed from a mixture of indium oxide and tin oxide or indium tin oxide (ITO). However, it is contemplated that other suitable light transmissive electrically conductive materials may be used to construct the first conductor layer **11**. Thin 90% Mg + 10% Ag (e.g. 10nm) and LiF (1nm) over Al (10nm) could be used as transparent electrodes for an inverted OLED stack. 50nm of ITO on 100nm of Al + 4% Cu or much thicker films of previously mentioned materials could be used for upwardly emitting versions of the present invention. Pixel areas, not shown, are then formed on the first conductor layer **11** by depositing an insulator layer on the first conductor layer **11** using conventional techniques.

An OLED layer **12** is then deposited on the insulator layer and first conductor layer **11** such that the OLED layer **12** contacts the first conductor layer **11** in the pixel area, as shown in Fig. 1. The OLED layer **12** preferably comprises one or more layers of organic film(s). Preferably, the OLED layer **12** includes a hole transport layer, at least one light emitting layer and an electron transport layer. The light emitting layer is sandwiched between the hole transport layer and electron transport layer. The OLED layer **12** is preferably transparent.

A thin second conductor layer **13** is formed on the OLED layer **12**. The second conductor layer **13** is preferably transparent and formed from a metal (e.g., Mg and Ag alloys or Al and Cu and Ti alloys, molybdenum, cobalt, nickel, zinc, indium diamond like carbon (DLC), ITO, SiC, CuPc, etc.). In a preferred embodiment, the second conductor layer **13** has a thickness in the range of 1 to 150 Angstroms. A thin ion damaged layer of CuPc or Alq may be used as a recombination injection site. The second conductor layer **13** should be sufficiently thin to minimize light absorption and discontinuous to limit lateral conduction. Otherwise, the conductor layer **13** will short sideways to other pixels. If the second conductor layer **13** is a discontinuous film, a thickness of 1 to 2 Angstroms may be acceptable for charge generation. If the second conductor layer **13** is patterned, then it may have a thickness in the range of 50 to 150 Angstroms. When an

electric current is applied to the device, negatively charged electrons are generated and move into the OLED layer **12** from the second conductor layer **13**. Positive charges or holes are generated and move into the OLED layer **12** from the first conductor layer **11**. The electrons and holes meet in the OLED layer **12**, where they combine and produce photons.

A second organic light emitting device **20** is formed on the first organic light emitting device **10**. The second organic light emitting device **20** includes a first conductor layer **21**. The conductor layer **21** is preferably formed from the same materials as described above in connection with conductor layer **11**.

An OLED layer **22** is then deposited on the first conductor layer **21** such that the OLED layer **22** contacts the first conductor layer **21** in the pixel area. As described above in connection with OLED layer **12**, the OLED layer **22** preferably comprises one or more layers of organic film.

A thin second conductor layer **23** is formed on the OLED layer **22**. The second conductor layer **23** is also preferably transparent and formed from a metal, as described above in connection with the second conductor layer **13**.

In the embodiment of the present invention illustrated in Fig. 1, the first conductor layer **21** of the second organic light emitting device **20** may be formed directly on the thin second conductor layer **13** of the first organic light emitting device **10**. In this manner, nonmetallic electron and hole injector layers may be used. It is advisable to shadow mask the thin metal layers so that they are smaller than the organic layers. For pixel isolation, the metal layers may not be continuous to prevent sideways shorting, as described above.

The OLED stack order can be inverted and will still work if the voltages are reversed. Light can be emitted from either the top electrode, bottom electrode, or both sides of the device by selecting suitable thicknesses for the top and bottom layers, the use of thick reflective, transmissive, or absorbing conductors on top or bottom of the stack.

Another embodiment of the present invention, illustrated in Fig. 2, includes a thin insulator material **100**, as shown in Fig. 2, deposited over the thin second conductor layer **13** prior to formation of the first conductor layer **21** to provide an insulative barrier

between the first and second organic light emitting devices **10** and **20**. The insulator layer **100** may be formed from suitable dielectric materials such as SiO, aluminum oxide, silicon nitride, and diamond like carbon films.

Another embodiment of the present invention is illustrated in Fig. 3. In this embodiment, the thin second conductor layer may be simultaneously formed with the first conductor layer as a single semiconductor layer **200** having a concentration gradient such that a pin junction is formed having a high reverse leakage current. This may be accomplished by, for example, chemical vapor deposition whereby the concentration of the material forming the second conductor portion **213** of the single layer **200** is highest (approximately 100%) adjacent the OLED layer **12**. The concentration of the material forming the second conductor portion **213** decreases as the distance from the OLED layer **12** increases. The concentration of the material forming the first conductor portion **221** of the single layer **200** is highest (approximately 100%) adjacent the OLED layer **22**. Similarly, the concentration of the material forming the first portion **221** decreases as the distance from the OLED layer **22** increases. Electrons generated in the layer **200** move downward into the OLED layer **12**. Holes generated in the layer **200** move upward into the OLED layer **22**.

A third organic light emitting device **30** is formed on the second organic light emitting device **20**, as shown in Fig. 1. The third organic light emitting device **30** includes a first conductor layer **31**. The transparent conductor layer **31** is preferably formed from a mixture such as indium oxide and tin oxide, (ITO), also indium zinc oxide (IZO), or indium aluminum oxide (IAO). A thin metal layer such as Mo (~ 100 Å) may also be used. However, it is contemplated that other suitable transparent light transmissive electrically conductive materials may be used to construct the first conductor layer **31**.

An OLED layer **32** is then deposited on the first conductor layer **31** such that the OLED layer **32** contacts the first conductor layer **31** in the pixel area. As described above in connection with OLED layer **12**, the OLED layer **32** preferably comprises one or more layers of organic film.

A second conductor layer **33** is formed on the OLED layer **32**. The second conductor layer **23** is also preferably formed from a metal, as described above in connection with the second conductor layer **13**. The second conductor layer **23** can be formed from a bilayer of an electron injector and hole injector layer (e.g. 50 Angstroms ITO sputtered onto 50 Angstrom CuPc or Alq, which improves electron injection). In a preferred embodiment, the second conductor layer **33** has a thickness in the range of 1 to 100 Angstroms. The thinnest film of conductor possible permits minimum cross-talk between pixels. Discontinuous films are preferred.

The first conductor layer **31** of the third organic light emitting device **30** may be formed directly on the thin second conductor layer **23** of the second organic light emitting device **20**. Alternatively, a thin insulator material **100**, as described above, may be formed between the thin second conductor layer **23** and the first conductor layer **31** to provide an insulative barrier between the second and third organic light emitting devices **20** and **30**, as shown in Fig. 2. Alternatively, the thin second conductor layer may be simultaneously formed with the first conductor layer as single semiconductor layer **300** having a concentration gradient, as described above, with a first conductor layer portion **331** and a second conductor layer portion **323**.

A current from a current source **3** is equally applied to each of the individual organic light emitting devices **10**, **20**, and **30**. The current controls the current density. There is no independent control of the current applied to each of the individual organic light emitting devices **10**, **20**, and **30**. Light emitted from the third organic light emitting device **30** passes through the first and second organic light emitting devices **10** and **20** and the substrate **2**. Similarly, light emitted from the second organic light emitting device **20** passes through the first organic light emitting device **10** and substrate **2**. Light from the second and third organic light emitting devices **20** and **30** are partially impeded as the light passes through adjacent organic light emitting devices, as described above.

This arrangement produces a light emitting device **1** that is brighter than conventional single organic light emitting devices when the same current is applied. For example, for an organic light emitting device that is 80% transparent, 64% of the light emitted from the third organic light emitting device **30** is transmitted through the

substrate **2**. 80% of the light emitted from the second organic light emitting device **20** is transmitted through the substrate **2**. 100% of the light emitted from the first organic light emitting device **10** is transmitted through the substrate **2**. The brightness of light emitted from the present invention is increased by almost a factor of 3 over the conventional single organic light emitting device. This produces only a loss in power efficiency of about 20% as compared to as much as 60% for a conventional device operating at the same brightness with an ohmic series resistance. Furthermore, the light emitting device **1** would have the same power efficiency and lifetime as a single organic light emitting device of the same current density. Alternatively, the present invention produces a light emitting device **1** that produces the same brightness as a conventional organic light emitting device but at increased efficiency and improved lifetime because less current is required to produce the desired brightness.

While the lack of independent control of the layers may be initially perceived as a drawback of the present invention, those persons skilled in the art will quickly appreciate that a higher brightness will result with no additional current requirement resulting in an increased power efficiency and a lower heat output. The present invention, therefore, provides greater flexibility in increased brightness for an equivalent lifetime, or equivalent brightness for an increased lifetime. That flexibility makes the present invention superior to conventional organic light emitting devices.

In addition, it will be apparent to those skilled in the art that various modifications and variations can be made in the construction and configuration of the present invention without departing from the scope or spirit of the invention. For example, in the embodiment mentioned above, various changes may be made in the transparent materials or number of OLED layers, all while preserving the function of the present invention as described herein. The organic light emitting devices may each be different colors, so that the colors may be mixed in a fixed proportion to provide a white emitter. Similarly, the light emitter device may be a top emitter. In such an arrangement, the transparent first conductor layer **11** may be replaced with a reflective conductor to direct the light upward. Further, it may be appropriate to make various modifications in materials of the present invention, or in the mode of operation of a preferred embodiment of the present

invention. Thus, it is intended that the present invention cover the modifications and variations of the invention, provided they within the scope of the appended claims and their equivalents.

Additionally, the order of the first and second conductor layers may be reversed with a top transparent sputtered electrode of ITO on CuPc, Alq or thin metal (Al+Li or Mg+Ag, for example).

Additionally, it may be possible to stack the organic light emitting devices without including the intermediate conductor layers.

Additionally, it is possible to coevaporate the injector metal layers with the organic materials. This may permit better recombination and injection of the charges with minimal lateral conduction.

While this invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, the preferred embodiments of the invention as set forth herein are intended to be illustrative, not limiting. Various changes may be made without departing from the spirit and scope of the invention as defined in the following claims.

What is Claimed Is:

1. A light emitting device comprising:

a plurality of organic light emitting devices, wherein said plurality of organic light emitting devices are arranged in a stack; and

control means for controlling operation of said plurality of organic light emitting devices in said stack, wherein said control means supplies the same current to each of said organic light emitting devices in said stack.

2. The light emitting device according to claim 1, wherein said plurality of organic light emitting devices includes at least two stacked organic light emitting devices.

3. The light emitting device according to claim 1, further comprising a substrate, wherein said stack of organic light emitting devices is formed on said substrate.

4. The light emitting device according to claim 3, wherein said plurality of organic light emitting devices includes at least two stacked organic light emitting devices.

5. The light emitting device according to claim 4, wherein a first organic light emitting device of said plurality of organic light emitting devices is located on said substrate, and a second organic light emitting device of said plurality of organic light emitting devices is located on said first organic light emitting device.

6. The light emitting device according to claim 5, further comprising a thin discontinuous conductor layer positioned between said first and second organic light emitting devices with hole and electron injection capability on opposing sides.

7. The light emitting device according to claim 5, further comprising a semiconductor layer positioned between said first and second organic light emitting devices.

8. The light emitting device according to claim 5, further comprising a third organic light emitting device, where said third organic light emitting device is located on said second organic light emitting device.

9. The light emitting device according to claim 8, further comprising a conductor layer positioned between said second and third organic light emitting devices.

10. The light emitting device according to claim 8, further comprising a semiconductor layer positioned between said second and third organic light emitting devices.

11. The light emitting device according to claim 5, wherein each of said organic light emitting devices comprises:

a first conductor layer;

an OLED layer; and

a second conductor layer, wherein said OLED layer is sandwiched between said first and second conductor layers.

12. The light emitting device according to claim 11, wherein each of said second conductor layers of said organic light emitting devices has a thickness, wherein said thickness of said second conductor layer of said third organic light emitting device is greater than said thickness of said second conductor layers of said first and second organic light emitting devices.

13. The light emitting device according to claim 12, further comprising an insulator layer positioned between each of said organic light emitting devices.

14. The light emitting device according to claim 1, wherein said device has increased brightness.

15. The light emitting device according to claim 1, wherein said device has increased efficiency.

16. The light emitting device according to claim 1, wherein said device has increased lifetime.

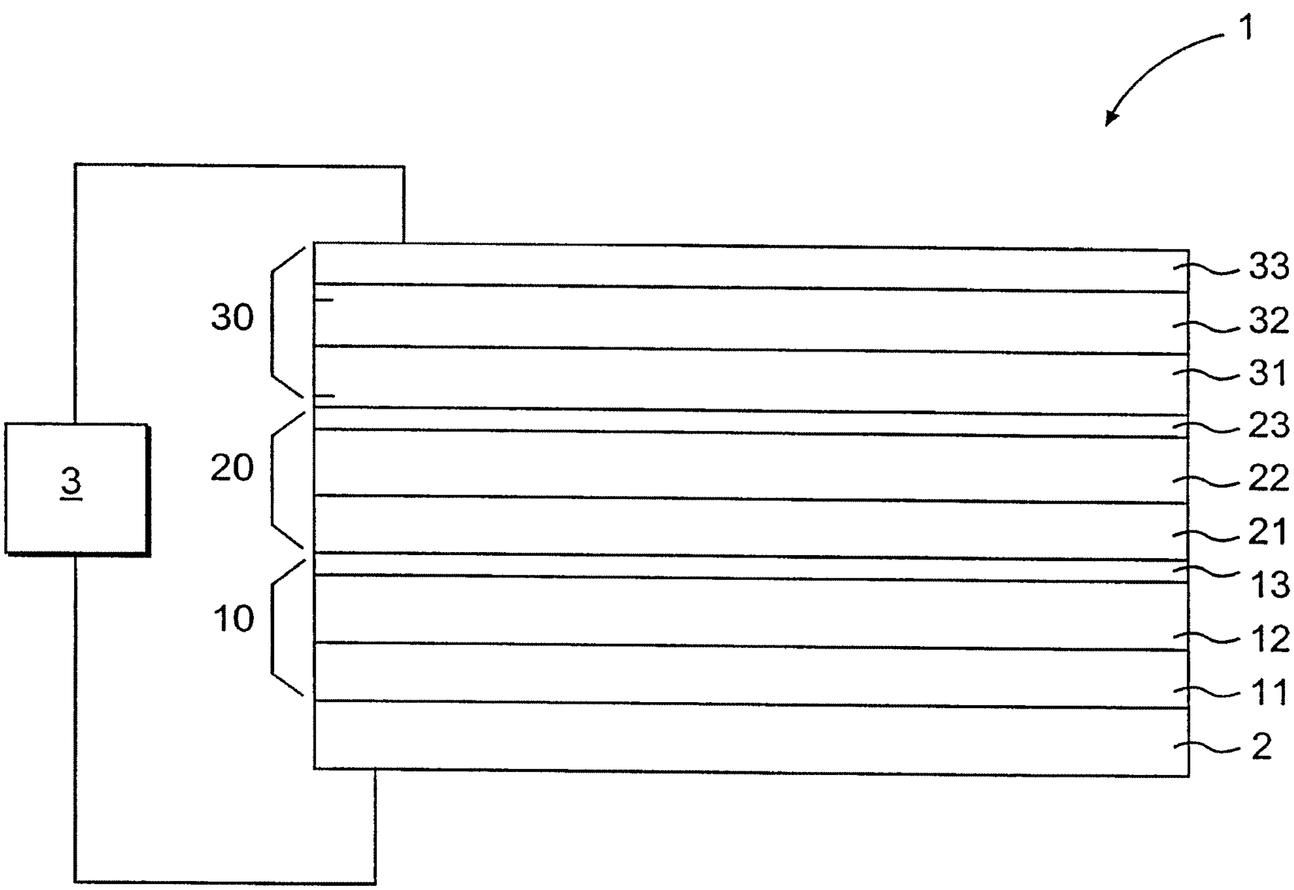


FIG. 1

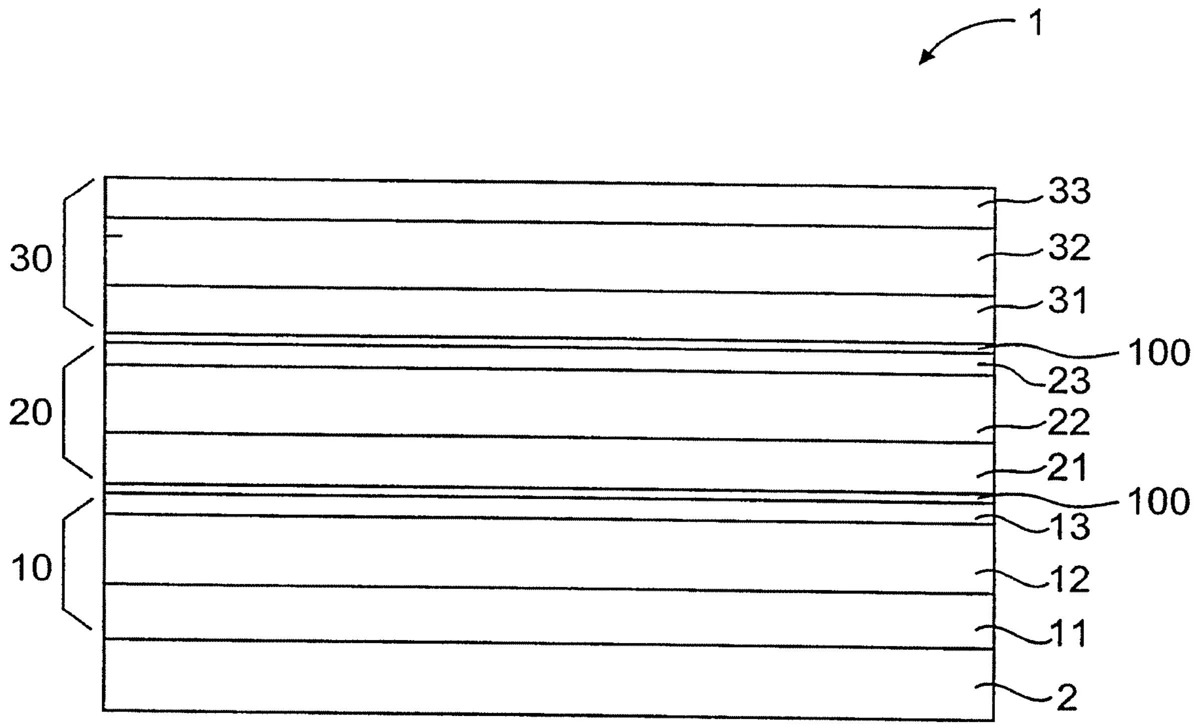


FIG. 2

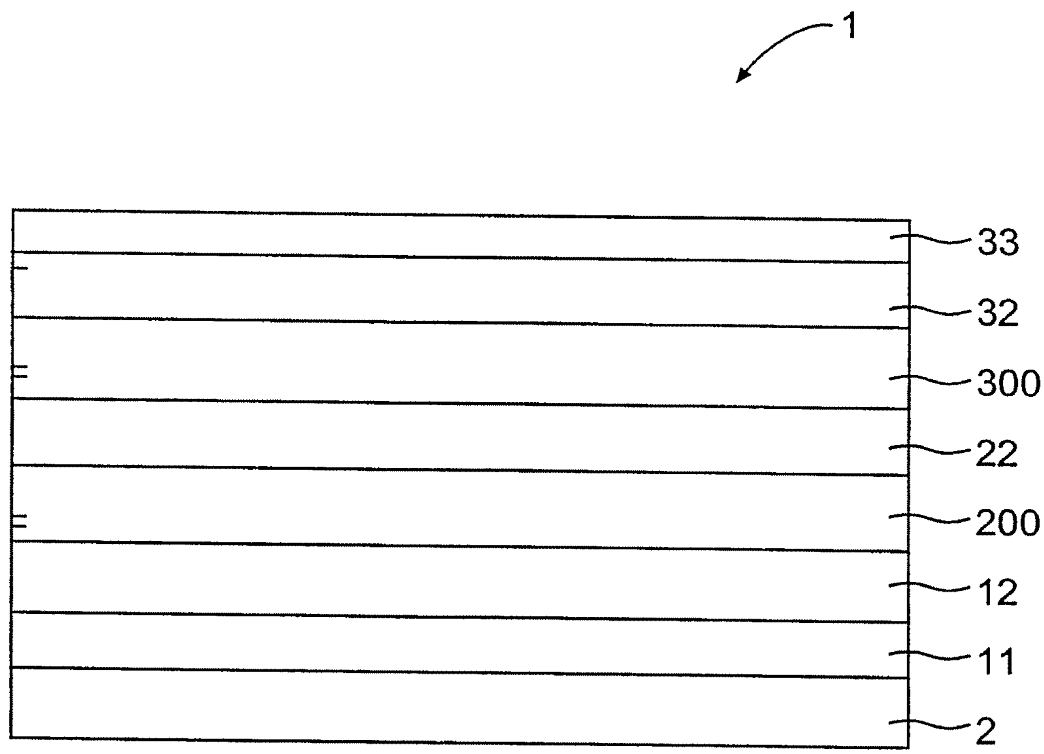


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/13936

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : HO1L 33/00
US CL : 257/89, 103
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 257/89, 103

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS
search terms: organic, light emitting, led, oled, stack?

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	US 5,757,026 A (FORREST et al.) 26 May 1998, see entire document, especially ABSTRACT, FIGs. 2A, 2B, 14A and 15.	1-16
X,P	US 5,721,160 A (FORREST et al.) 24 February 1998, see entire document.	1-16
X,P	US 5,707,745 A (FORREST et al.) 13 January 1998, see entire document.	1-16
A,P	US 5,739,552 A (KIMURA et al.) 14 April 1998, see entire document.	1-16

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 SEPTEMBER 1998	29 OCT 1998

Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	B. WILLIAM BAUMEISTER
Facsimile No. (703) 308-7722	Telephone No. (703) 308-0956